UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Ex parte BRIGITTE BENAGE, GERALD J. ABRUSCATO, ANDREW J. EISENSTEIN, KIRK A. SCHLUP, RUBEN S. GREWAL, and BRENDAN J. GEELAN

Appeal 2006-2694
Application 09/910,968
Technology Center 1700

ON BRIEF

Before MILLS, GRIMES, and GREEN, *Administrative Patent Judges*.

GRIMES, *Administrative Patent Judge*.

DECISION ON APPEAL

This appeal involves claims to processes of inhibiting the polymerization of monomers. The examiner has rejected the claims as obvious. We have jurisdiction under 35 U.S.C. § 134. We affirm.

BACKGROUND

"Many ethylenically unsaturated monomers undesirably polymerize at various stages of their manufacture, processing, handling, storage, and use." (Specification 1.) Undesired polymerization results in a lower yield of

monomer, increased energy cost, and equipment fouling "owing to the deposition of polymer in or on the equipment being used." (Specification 1.)

"A wide variety of compounds has been proposed and used for inhibiting uncontrolled and undesired polymerization of ethylenically unsaturated monomers." (Specification 2.) The Specification discloses that "nitroxyl radicals are highly efficient polymerization inhibitors under normal use, providing better performance than most other inhibitors on the market . . . ." (Specification 5.)

Many manufacturers improve the economics of producing monomers by recycling and reusing the polymerization inhibitor. (Specification 13.) "It is known in the industry that the recycling of streams utilizing nitroxyls as polymerization inhibitors in plants employing temperatures in excess of about 115° C causes loss of inhibitor efficiency, such that the tar recycle leads to a higher polymer content than would be expected or desirable." (Specification 13.)

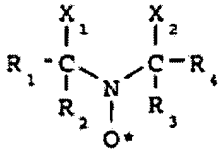
DISCUSSION

1. CLAIM CONSTRUCTION

Claims 1, 2, 9, and 17-26 are pending and on appeal. We will focus on claims 1, 2, 9, and 18, which read as follows:

1. In a process for the production and purification of unsaturated monomers employing distillation means and a nitroxyl-containing polymerization inhibitor of said monomers, wherein a process stream containing the nitroxyl-containing inhibitor is removed downstream of the distillation means and returned to the process ahead of the distillation means, the improvement which comprises recycling said stream containing the nitroxyl-containing inhibitor into the distillation means, wherein the temperature in the distillation means is no higher than about 110° C and the pressure is less than 760 mm Hg.

2. The process of claim 1 wherein the nitroxyl-containing inhibitor is of the following structural formula:



wherein
R_1 and R_4 are independently selected from the group consisting of hydrogen, alkyl, and heteroatom-substituted alkyl;
R_2 and R_3 are independently selected from the group consisting of alkyl and heteroatom-substituted alkyl; and
X_1 and X_2
(1) are independently selected from the group consisting of halogen, cyano, amido, -S-C_6H_5, carbonyl, alkenyl, alkyl of 1 to 15 carbon atoms, $COOR_7$, -S-COR_7, and -$OCOR_7$, wherein R_7 is alkyl or aryl, or
(2) taken together, form a ring structure with the nitrogen.

9. The process of claim 1 wherein the distillation is a continuous operation.

18. The process of claim 2 wherein the inhibitor is a blend of two nitroxyls.

Because the body of claim 1 recites an improvement to the process recited in the preamble, claim 1 is a Jepson format claim. *See Sjolund v. Musland*, 847 F.2d 1573, 6 USPQ2d 2020 (Fed. Cir. 1988). "[T]he preamble of a Jepson claim is impliedly admitted to be prior art." *Id.* at 1577, 6 USPQ2d at 2023.

Thus, claim 1 impliedly acknowledges that a process using distillation means to prepare unsaturated monomers in the presence of nitroxyl inhibitors was known in the art, as was the fact that the nitroxyl inhibitor was removed downstream of the distillation means and returned to the process ahead of the distillation means. The body of the claim requires the

nitroxyl-containing inhibitor in the prior art process to be recycled into the distillation means, and also requires the temperature of the distillation means to be no higher than 110°C, and the pressure to be less than 760 mm Hg.

Claim 2 requires the nitroxyl inhibitor of claim 1 to have a specific structural formula.

Claim 9 requires the distillation of claim 1 to be a continuous operation.

Claim 18 recites the process of claim 2, with the additional requirement that the inhibitor must be a blend of two nitroxyls.

2. OBVIOUSNESS

Claims 1, 2, 9, and 17-26 stand rejected under 35 U.S.C. § 103 as obvious in view of Arhancet[1] and Higgins.[2]

The Examiner cites Arhancet as describing "a method for inhibiting premature polymerization of vinyl aromatic monomers," using nitroxyl inhibitors having the claimed formula, "at a temperature of 110°C and under reduced vacuum." (Answer 3 (citing Arhancet at col. 1, ll. 16-17; col. 2, line 10, through col. 3, line 7; claims 6 and 8).) The Examiner acknowledges that Arhancet differs from claim 1 in that "Arhancet does not disclose a step of recycling the inhibitor to the distillation column." (Answer 3.)

To meet this limitation, the Examiner cites Higgins as "disclos[ing] a process for production/purification of an unsaturated monomer wherein the inhibitor is recycled back to the distillation column (see the Figure)."

---

[1] Arhancet, U.S. Patent 5,907,071, issued May 25, 1999.
[2] Higgins, Jr. et al., U.S. Patent 4,033,829, issued July 5, 1977.

(Answer 3.) The Examiner argues that one of ordinary skill in the art would have considered it obvious "to have modified the process of Arhancet by recycling the inhibitor back to the distillation column as taught by Higgins because the recycling step would cut down the cost of fresh inhibitor." (Answer 3.)

The Examiner states, "[r]egarding claim 9, Arhancet does not specifically disclose that the distillation is a continuous operation." (Answer 4.) The Examiner asserts, however, that one of ordinary skill would have considered it obvious "to have modified the process of Arhancet by operating the process continuously because Higgins teaches that similar results would be expected when the distillation is operated in either continuous or batch mode." (Answer 4.)

The Examiner also concedes that "Arhancet does not specifically disclose that the inhibitor is a blend of two nitroxyls" as recited in claim 18. (Answer 4.) The Examiner urges, however, that because each of Arhancet's nitroxyl inhibitors "has an equivalent function," one of ordinary skill would have considered it obvious "to have modified the process of Arhancet by using a blend of two nitroxyls because it would be expected that the mixture of the two nitroxyls would have similar results as a single nitroxyl inhibitor." (Answer 4.)

The Examiner may establish a prima facie case of obviousness based on multiple references "only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references." *In re Fine*, 837 F.2d 1071, 1074, 5 USPQ2d 1596, 1598 (Fed.

Cir. 1988). The reason for practicing the claimed subject matter may be explicit from the prior art, *In re Kotzab*, 217 F.3d 1365, 1370, 55 USPQ2d 1313, 1317 (Fed. Cir. 2000) (citations omitted), or the

> teaching, motivation or suggestion may be implicit from the prior art as a whole, rather than expressly stated in the references. The test for an implicit showing is what the combined teachings, knowledge of one of ordinary skill in the art, and the nature of the problem to be solved as a whole would have suggested to those of ordinary skill in the art.

Id.

We agree with the Examiner that the teachings of Arhancet and Higgins would have suggested the process recited in claims 1, 2, 9, and 18 to one of ordinary skill in the art.

Arhancet discloses the preparation of vinyl aromatic monomers, i.e., unsaturated monomers such as styrene, under processing conditions including vacuum distillation, in the presence of a nitroxyl inhibitor meeting the formula of claim 2. (Arhancet, col. 2, ll. 8-52.) Arhancet notes that styrene "is typically processed at temperatures between 95° and 125° C" (Arhancet, col. 3, ll. 7-8), a temperature range overlapping the range recited in claim 1. We take official notice that atmospheric pressure is 760 mm Hg; therefore, Arhancet's "vacuum distillation" reasonably appears to describe distillation under a pressure of less than 760 mm Hg, as recited in claim 1.

Higgins discloses that a dinitrophenol inhibitor used in preparing styrene monomer can be recycled from the product stream back to the initial distillation column. (Higgins, Figure.) We agree with the Examiner that one of ordinary skill practicing Arhancet's process would have recognized that

reusing the inhibitor in the manner taught by Higgins would have provided a cost benefit.

Higgins also teaches that the process of preparing styrene monomer which includes an inhibitor recycling step "can be operated on . . . a continuous . . . basis" (Higgins col. 3, ll. 32-33), as recited in claim 9.

Regarding the use of a blend of two nitroxyl inhibitors, Arhancet discloses that a plurality of nitroxyl inhibitors is useful in preparing styrene monomers. (Arhancet, col. 2, ll. 3-7 and 28-52.) Because one of ordinary skill would have recognized that a combination of two of Arhancet's nitroxyl inhibitors would effectively inhibit polymerization, we agree with the Examiner that claim 18 would have been obvious.

Thus, taken together, Arhancet and Higgins would have suggested performing the steps recited in claims 1, 2, 9, and 18, at the temperatures and pressures recited in those claims.

Appellants argue that because the dinitrophenol polymerization inhibitor recycled in Higgins' styrene monomer production process is not a nitroxyl-containing compound, Higgins does not suggest the problems of "using nitroxyl-containing compounds as inhibitors, nor does it suggest that problems involved in using nitroxyl-containing compounds as inhibitors can be overcome by recycling a stream containing such inhibitors at temperatures no higher than about 110°C *and* at pressures below 760 mm Hg, as required by the present claims." (Br. 6.) Rather, Appellants urge, Higgins discloses operation of the distillation column at an overhead pressure of 414 mm Hg, resulting in a bottoms temperature of about 131°C,

"precisely the kind of distillation temperature the present Applicants have taught is to be avoided." (Br. 6.)

We do not find Appellants' argument persuasive. Arhancet clearly teaches that nitroxyl compounds should be used as inhibitors when preparing styrene monomer, despite any difficulties their use might entail. (Arhancet, col. 2, ll. 28-52.)

Also, as pointed out by the Examiner (Answer 4-5), the Specification states that: "It is known in the industry that the recycling of streams utilizing nitroxyls as polymerization inhibitors in plants employing temperatures in excess of about 115° C causes loss of inhibitor efficiency, such that the tar recycle leads to a higher polymer content than would be expected or desirable." (Specification 13.)

We agree with the Examiner (Answer 5) that, given the knowledge in the industry that recycling nitroxyl inhibitors above 115°C causes loss of inhibitor efficiency, one skilled in the art using Higgins' recycling step in Arhancet's process would have considered it obvious to perform the recycling step at the claimed temperature of 110°C or less. In our view, when the prior art discloses that performing a process above a certain temperature leads to undesirable results, one of ordinary skill would have considered it obvious to use a lower temperature.

Appellants also point out that Higgins discloses that recycling the dinitrophenol inhibitor results in an inhibitor which is more effective than commercial dinitrophenol inhibitors. (Br. 6 (citing Higgins, col. 1, ll. 61-66, and col. 4, Example 3).) Aware of the industry knowledge that recycling

nitroxyl inhibitors above 115°C conversely causes a loss of inhibitor efficiency, Appellants urge that one skilled in the art

> could hardly be expected to think of following the teaching of Higgins et al. to supplement the deficiencies of Arhancet. In other words, the behavior of dinitrophenols and nit[r]oxyl compounds are so totally different that the skilled practitioner would have no motivation whatsoever to combine the teaching of Higgins et al. with the teaching of Arhancet to come up with the present invention.

(Br. 6-7.)

We do not find Appellants' argument persuasive. As discussed *supra*, one of ordinary skill in the art would have recognized, from Higgins' teachings, the cost benefits of recycling and reusing the nitroxyl inhibitor in Arhancet's process.

In our view, the industry's recognition that recycling nitroxyl inhibitor above 115°C results in reduced inhibitor efficiency would not have led one of skill to altogether forego the cost savings of recycling the nitroxyl inhibitor. Rather, as also discussed *supra*, the art-recognized fact that recycling nitroxyl inhibitors above 115°C had undesirable effects would have led one of skill to use temperatures below that, as recited in claim 1.

To summarize, claim 1 recites a temperature range disclosed by Arhancet to be suitable for preparing styrene monomer in the presence of nitroxyl inhibitor. The temperature range recited in claim 1 also avoids the art-recognized problem of reduced efficiency of recycled nitroxyl inhibitors. Because the prior art suggests performing the claimed recycling step under the claimed process conditions, we agree with the Examiner that one of ordinary skill would have considered claims 1 and 2 obvious over the prior art.

Regarding claim 9, Appellants argue that, while continuous operations are well known, "the use of a continuous operation wherein the continuity includes the recycling of a nitroxyl inhibitor presents special problems with regard to effectiveness that one does not encounter with other inhibitors, such as dinitrophenols." (Br. 7.) Appellants argue that neither Arhancet nor Higgins, alone or in combination, suggests how to overcome these problems. (Br. 7.)

We do not find this argument persuasive. Appellants do not cite any evidence of record to support their argument, and our review of Arhancet and Higgins does not provide any suggestion that the teachings of the references cannot be combined in the manner set forth in the rejection. Thus, Appellants' argument regarding claim 9 is not based on any factual evidence of record. It is well established that argument by counsel cannot take the place of evidence. *In re Cole*, 326 F.2d 769, 773, 140 USPQ 230, 233 (CCPA 1964); *In re Geisler*, 116 F.3d 1465, 1471, 43 USPQ2d 1362, 1365 (Fed. Cir. 1997).

Regarding claim 18, Appellants urge that "[i]n the real world, where economics is a supreme consideration, scientists and engineers don't go around looking for ways to make commercial processes more complex in the absence of countervailing benefits that make the added cost of the more complex system acceptable." (Br. 8.) Thus, Appellants argue, in view of Arhancet's teaching of the use of a single nitroxyl compound, the person in charge of a styrene purification process would not have been motivated "to simply throw in a second or third nitroxyl compound, unless he was aware

of some good reason for doing so in the light of the increased cost it would entail. No such good reason is provided by Arhancet." (Br. 8.)

We do not find Appellants' argument persuasive. Appellants have provided no evidence showing that using a mixture of two nitroxyl compounds is more costly than using a single nitroxyl compound. Moreover, as pointed out by the Examiner (Answer 6):

> It is prima facie obvious to combine two compositions each of which is taught by the prior art to be useful for the same purpose, in order to form a third composition which is to be used for the very same purpose. . . . [T]he idea of combining them flows logically from their having been individually taught in the prior art.

In re Kerkhoven, 626 F.2d 846, 850, 205 USPQ 1069, 1072 (CCPA 1980) (citations omitted).

Thus, as discussed *supra*, Arhancet discloses that a plurality of nitroxyl compounds is useful in inhibiting the polymerization of styrene monomers in purification processes. (Col. 2, ll. 3-7 and 28-52.) One of ordinary skill would therefore have recognized that a combination of two of Arhancet's nitroxyl inhibitors would effectively inhibit polymerization in a styrene purification process. We agree with the Examiner that claim 18 would have been obvious in view of the prior art.

SUMMARY

Because the prior art suggests the process recited in claims 1, 2, 9, and 18, we affirm the Examiner's obviousness rejection of those claims. Claims 17 and 19-26 fall with claims 1, 2, 9, and 18.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 CFR § 1.136(a).

AFFIRMED

Demetra J. Mills)
Administrative Patent Judge)
)
)
) BOARD OF PATENT
Eric Grimes)
Administrative Patent Judge) APPEALS AND
)
) INTERFERENCES
)
Lora M. Green)
Administrative Patent Judge)

EG/FP/jlb

Michael P. Dilworth
Crompton Corporation
199 Benson Road
Middlebury CT 06749